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Laser deposition rates of thin films of selected metals and alloys

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Thin films of Cu, Zn and Sn as well as mixtures of these elements have been produced by Pulsed Laser Deposition (PLD). The deposition rate of single and multicomponent metallic targets was determined. The strength of PLD is that the stoichiometry of complex compounds, even of complicated alloys or metal oxides, can be preserved from target to film. We apply this technique to design films of a mixture of Cu, Zn and Sn, which are constituents of the chalcogenide CZTS, which has a composition close to Cu_2ZnSnS_4. This compound is expected to be an important candidate for absorbers in new solar cells.

The experiments have been carried out at a laser wavelength of 355 nm in vacuum with a PLD chamber at DTU Fotonik, Risø Campus. The deposition rates have been measured by a quartz crystal microbalance. At a laser fluence of 2 J/cm^2 the total ablated yield of copper is about 1x10^{15} atoms per pulse. The film deposition rate is typically 100 times lower because not all the ablated atoms do arrive at the substrate. The deposition rate of copper is about 1x10^{13} atoms/cm^2 per pulse in a direction normal to the target surface, which is 6 times lower than that of Sn and 4 times lower than that of Zn. Results for alloys of the different elements as well as compounds with S will be presented.